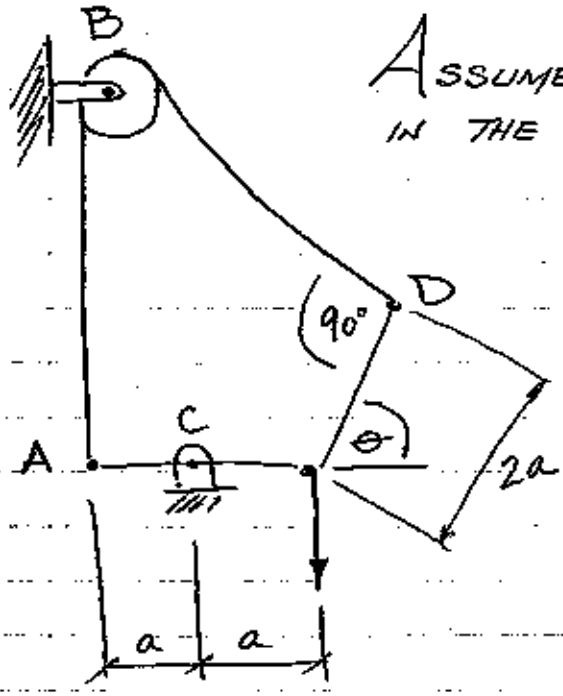
MECH 234
MILANO



ASSUME NO FRICTION IN THE PULLEY @ B.

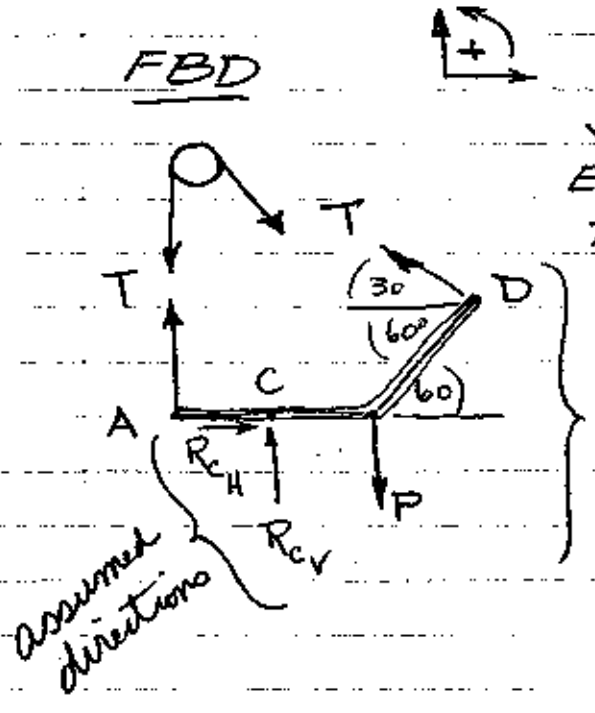
P4.31
p. 171

FIND: CABLE TENSION in ABD + REACTION @ C

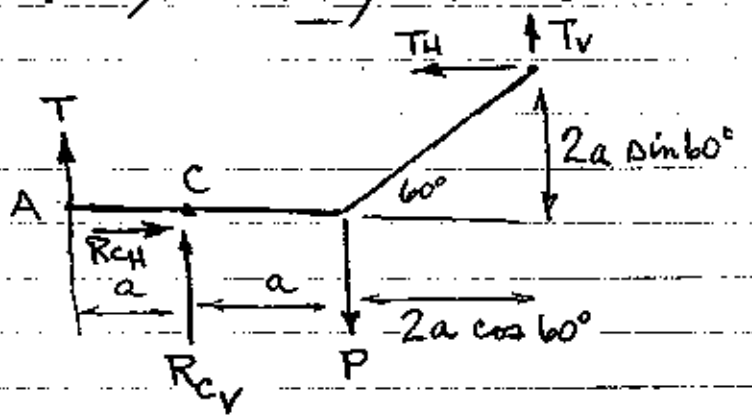
GIVEN: $\theta = 60°$

SOLUTION SHOULD BE IN TERMS OF 'P' and 'a'

FBD



SINCE THE CABLE TENSION IS EQUAL + OPP. (or the same) THROUGHOUT THE CABLE, ANALYZE ONLY THE BAR.



where $T_H = T \cos 30° = .866T$

$T_V = T \sin 30° = .5T$

$\Sigma F_x = 0 = +R_{C_H} - T_H \quad \therefore \boxed{R_{C_H} = .866T}$

$\Sigma F_y = 0 = +T + R_{C_V} - P + T_V$

$\therefore R_{C_V} = P - T_V - T \quad = \boxed{P - 1.5T = R_{C_V}}$

P4.31 cont'd.

Use pt. C as the pivot for the moments eq.

$$\sum \vec{M}_C = 0 = -T\vec{a} - P\vec{a} + T_H(2a\sin 60^\circ) + T_V(2a\cos 60^\circ + a)$$

$$0 = -Ta - Pa + (.866T)(2a \times .866) + (.5T)(2a \times .5 + a)$$

Since all terms have an 'a', divide by 'a' to eliminate that variable.
Rewrite the eq. w/ P on one side.

$$P = -T + (.866 \times 2 \times .866)T + (.5 \times 2 \times .5 + .5)T$$
$$= -T + 1.5T + 1.0T$$
$$P = 1.5T$$
$$\therefore T = 0.667P \quad \text{or} \quad \boxed{T = \frac{2}{3}P}$$

SUBSTITUTE BACK INTO FORCE EQ.
where $R_{C_H} = .866T = .866\left(\frac{2}{3}P\right)$

$$\boxed{R_{C_H} = 0.58P} \rightarrow \text{assumed correct.}$$

and $R_{C_V} = P - 1.5T = P - \frac{3}{2}\left(\frac{2}{3}P\right) = 0$

$$\boxed{\therefore R_{C_V} = 0}$$

CONCLUSION: The pin at pt. C experiences no vertical force; only the HORIZONTAL RESISTANCE.